Cranes

Major Causes of Crane Accidents

- Contact with power lines
- Overturns
- Falls
- Mechanical failures

How Do Accidents Occur?

- ***Instability*** **– unsecured load, load capacity exceeded, or ground not level or too soft**
- ***Lack of communication*** **- the point of operation is a distance from the crane operator or not in full view of the operator**
- ***Lack of training***
- ***Inadequate maintenance or inspection***

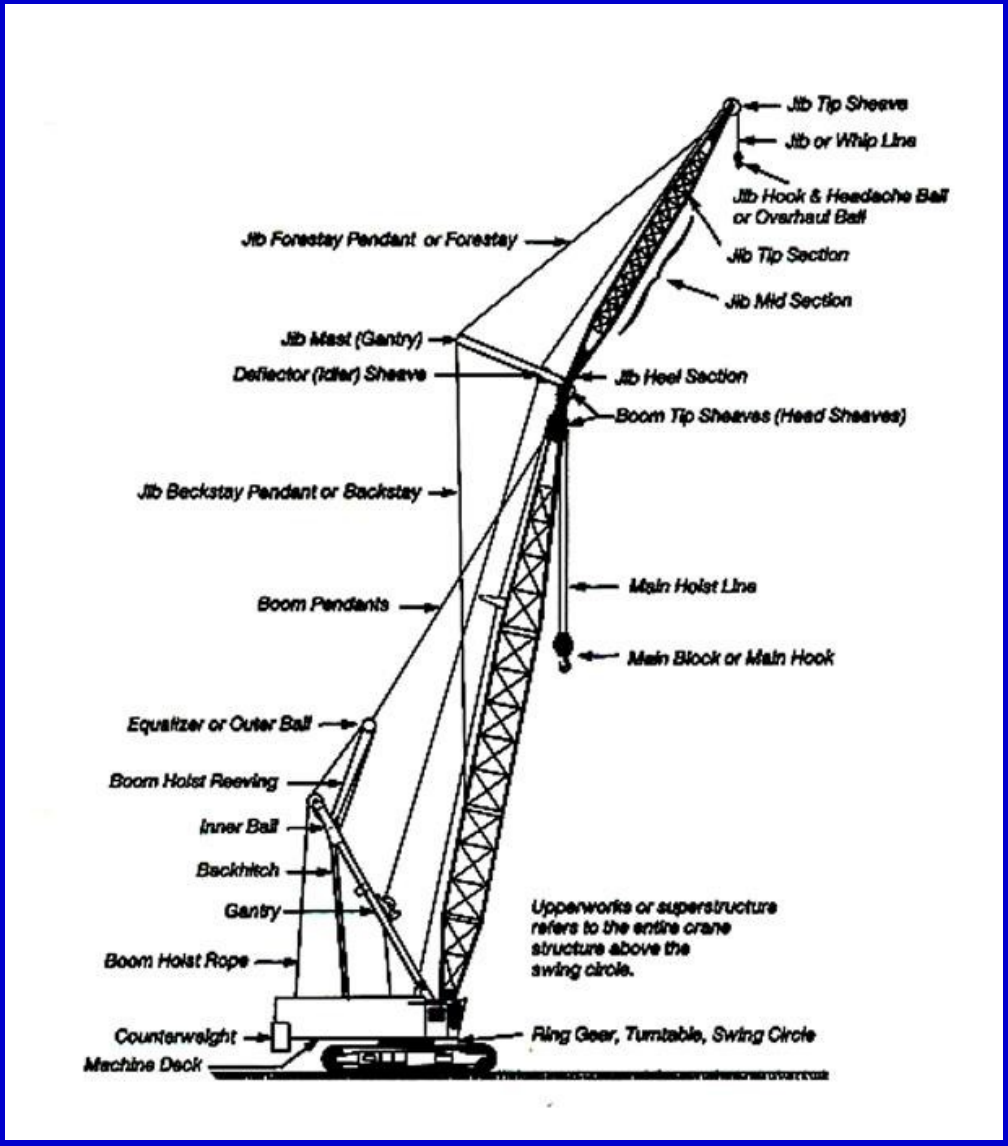
Who is at Risk

- Operators
- Persons at Crane Site

Definitions

- **Crane** – Consists of a rotating structure for lifting and lowering horizontally on rubber tires or crawler treads
- **Hoist** - Used to lift and lower load.
- **Boom** – An inclined spar, strut, or other long member supporting the hoisting tackle
- **Boom stops** – A device used to limit the angle of the boom at its highest position
- **Brake** – To slow or stop motion by friction or power
- **Block** – Sheaves or grooved pulleys in a frame with hook, eye and strap
- **Jib** – Extension attached to the boom point to provide added boom length for lifting specified loads.

Crane Parts


Jib Tip Sheave
Jib or Whip Line
Jib Hook & Headache Ball or Overhaul Ball
Jib Tip Section
Jib Mid Section
Jib Forestay Pendant or Forestay
Jib Mast (Gantry)
Deflector (Idler) Sheave
Jib Heel Section
Boom Tip Sheaves (Head Sheaves)
Jib Backstay Pendant or Backstay
Main Hoist Line
Boom Pendants
Main Block or Main Hook
Equalizer or Outer Ball
Boom Hoist Reeving
Inner Ball
Backhitch
Gantry
Boom Hoist Rope
Upperworks or superstructure refers to the entire crane structure above the swing circle.
Counterweight
Machine Deck
Ring Gear, Turntable, Swing Circle

Types of Cranes

- Mobile
- Hydraulic
- Overhead
- Gantry
- Tower

Crane Hazards

- Improper load rating
- Excessive speeds
- No hand signals
- Inadequate inspection and maintenance
- Unguarded parts
- Unguarded swing radius

- Working too close to power lines
- Improper exhaust system
- Shattered windows
- No steps/guardrails walkways
- No boom angle indicator
- Not using

Planning Before Start-Up

- Level the crane and ensure support surface is firm and able to support the load
- Contact power line owners and determine precautions. Know the location and voltage of overhead power lines.
- Know the basic crane capacities, limitations, and job site restrictions, such as the location of power lines, unstable soil, or high winds.
- Make other personnel aware of hoisting activities.
- Barricade areas within swing radius.
- Ensure proper maintenance and inspections.
- Determine safe areas to store materials and place machinery.

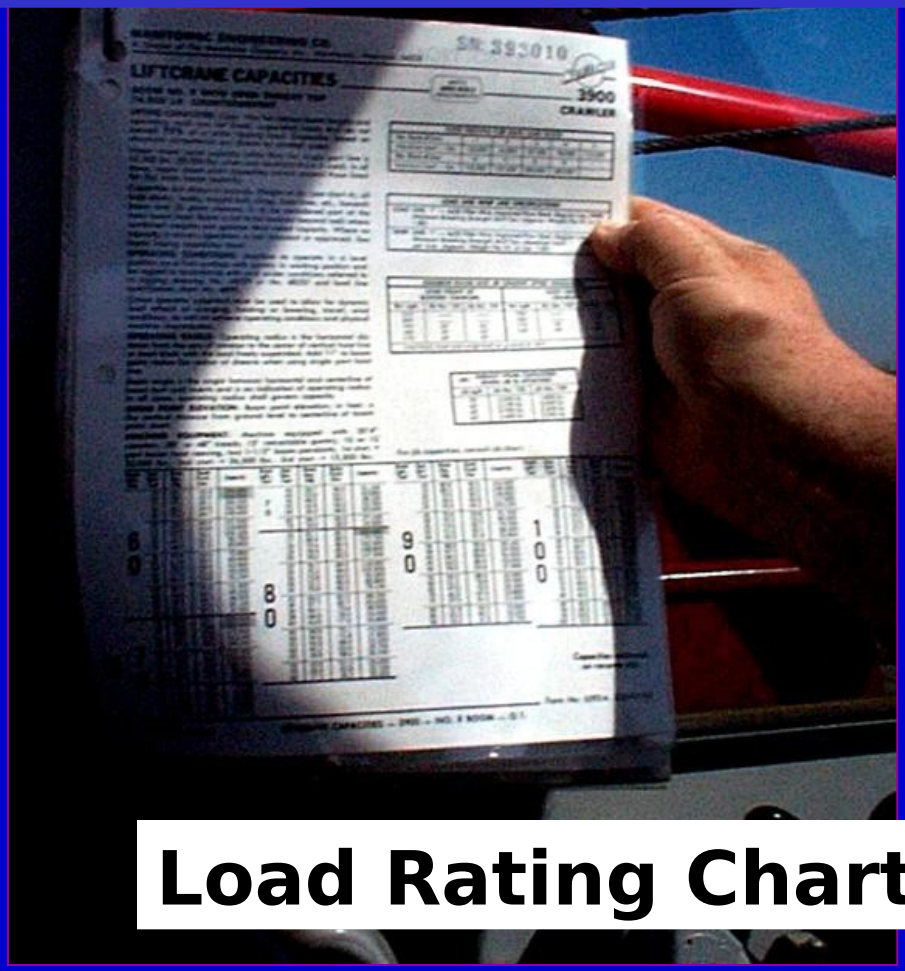
Competent Person

The competent person must inspect all machinery and equipment prior to each use, and during use, to make sure it is in safe operating condition.

If it needs fixing, take it out of service and don't use it until it is fixed

Load Capacity - Speed - Warnings

- Make sure the crane operator can see the:
  - Rated Load Capacities
  - Operating Speeds
  - Special Hazard Warning or Instruction



Load Rating Chart

Know the Weight of the Load

- Refer to shipping ticket or other documentation
- Ensure lift calculations are correct
- Ensure load is within load chart rating for boom length and load radius of crane
- Crane is rated by the maximum weight it will lift at a minimum radius and minimum boom length – the further from its centerpoint, the less it will lift

Load Limiting Factors

- Not level
- Wind
- Side loads
- On its wheels
- Lifting over the side
- Use of extensions, jibs and other attachments
- Limits of wire rope, slings and lifting devices

Mobile Cranes – Lifting Principles

- Center of Gravity
- Leverage
- Stability
- Structural Integrity

Load Example – 30 ton crane

- Will lift 60,000 pounds at 10 feet from the center pin of the crane
- Based on level surface, no wind, and outriggers fully extended
- At 25 feet from the center pin with an 80 foot boom, the capacity is only 14,950 pounds
- At 74 feet from the center pin, the capacity is only 4,800 pounds

Improper Load

Improper Load

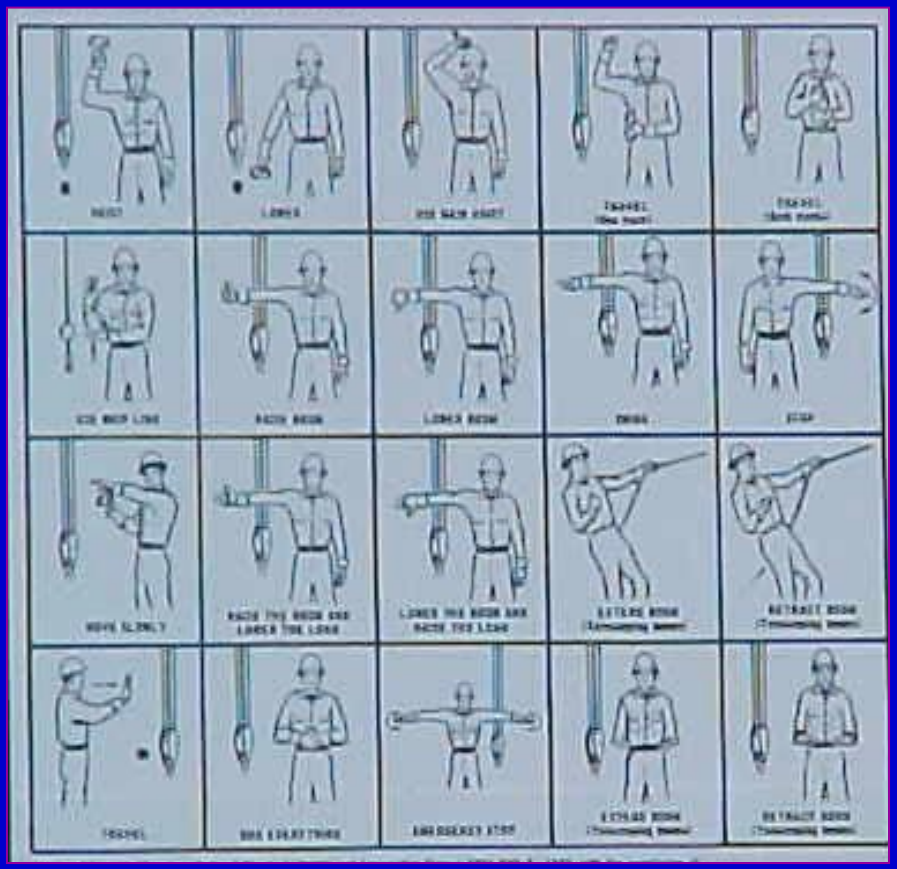
Improper Load

Power Lines

Stay clear from power lines at least 10 feet

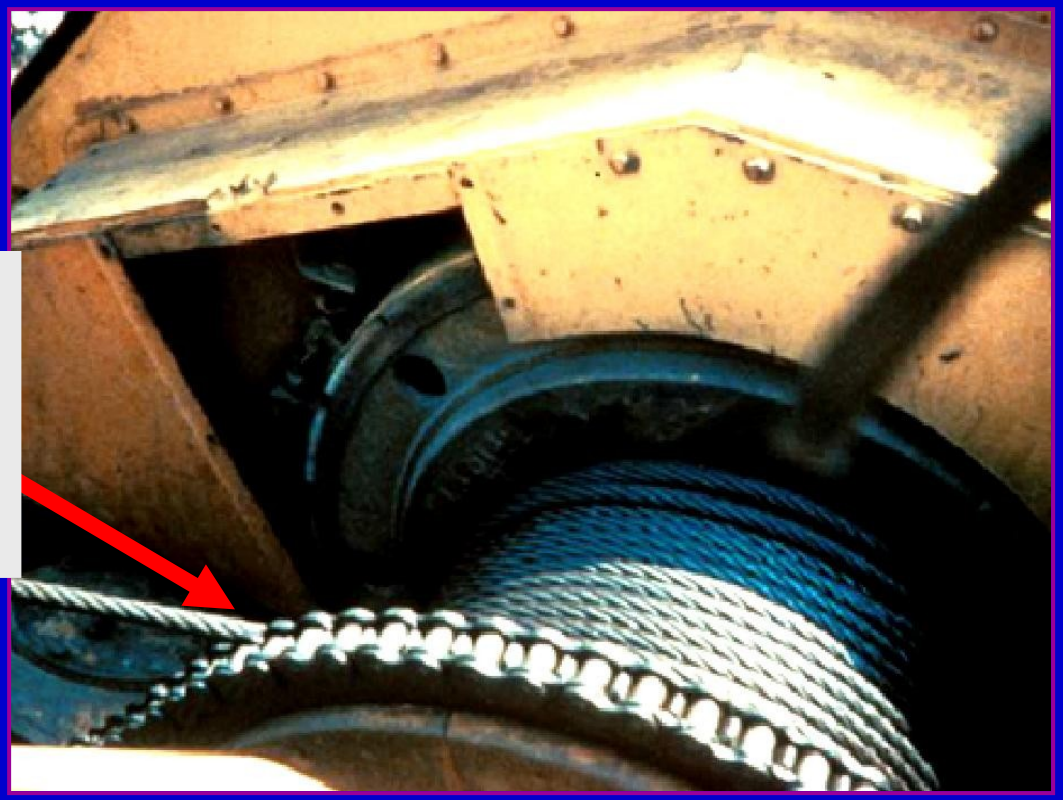
Hand Signals

An illustration of the signals must be posted at the job site



Guard Moving Parts

Unguarded Chain Drive

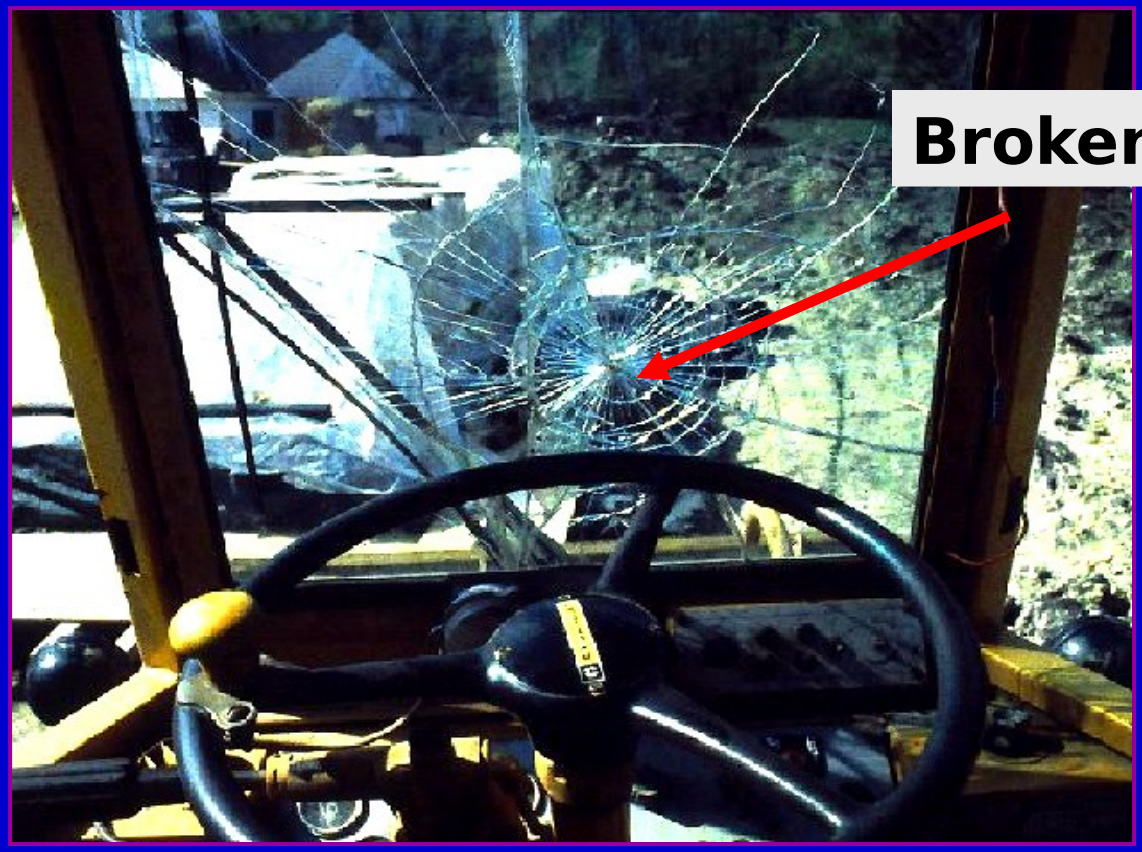


Guard moving parts such as gears or belts

Swing Radius

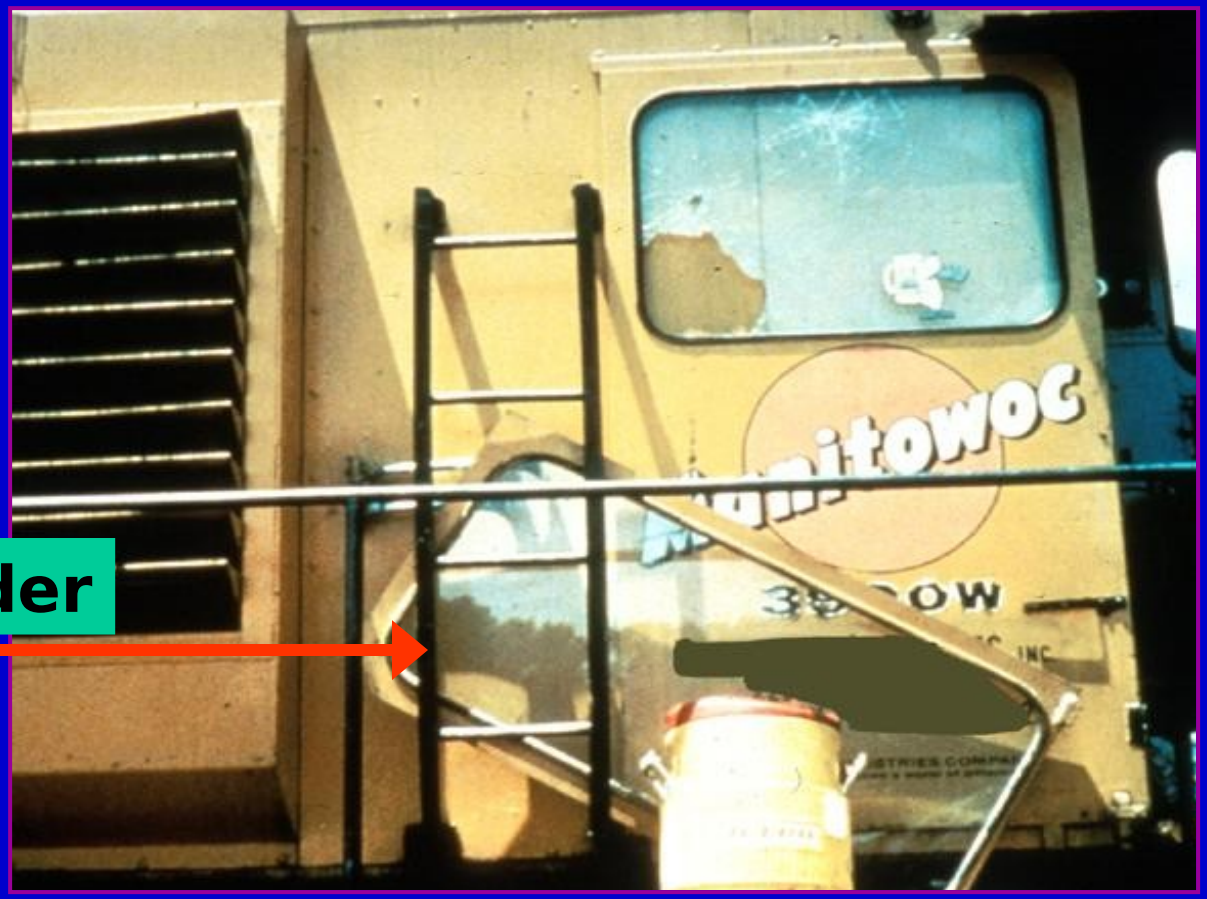
Stay out of the swing radius of the crane –
Make sure there are barrier guards showing swing radius

Operator Visibility



Make sure broken windows or other obstructions do not prevent the operator from seeing

Ladders



Use ladders to get to the upper portion of the cab

Guardrails

Runways and steps need to have guardrails,
handholds and slip resistant surfaces

Suspended Loads

Don’t stand under suspended loads

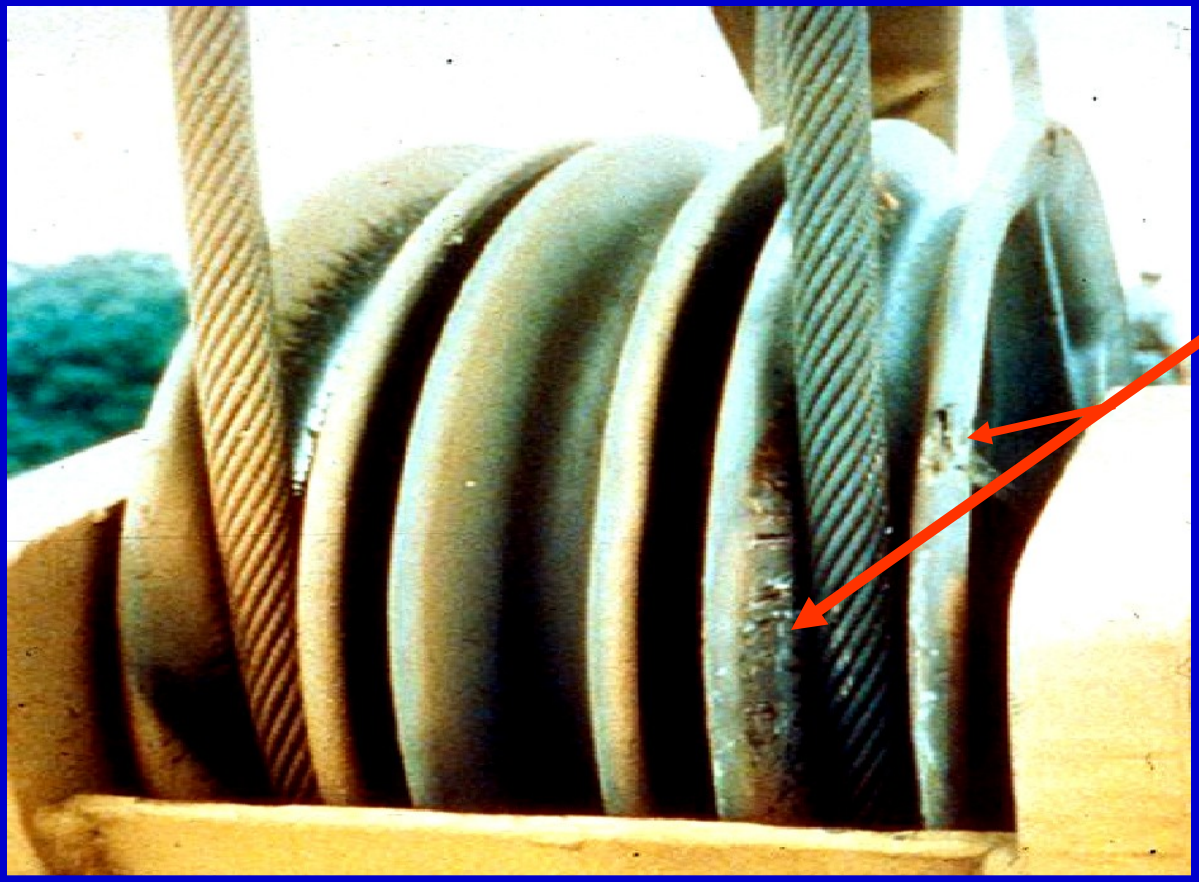
Boom Angle Indicator

A boom angle indicator must be on the crane

Supporting Surface

Cranes must be on a firm supporting surface and level within 1 percent

Sheaves



The grooves must be smooth and free from surface defects which could cause rope damage

Rigging Equipment Slings

Types of slings include alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope, and synthetic web.

Chain

Wire rope

Metal mesh

Synthetic

Annual Inspections

Inspection of the hoisting machinery must be made by a competent person

The employer must maintain a record of these inspections

Crane wasn't inspected and tipped over

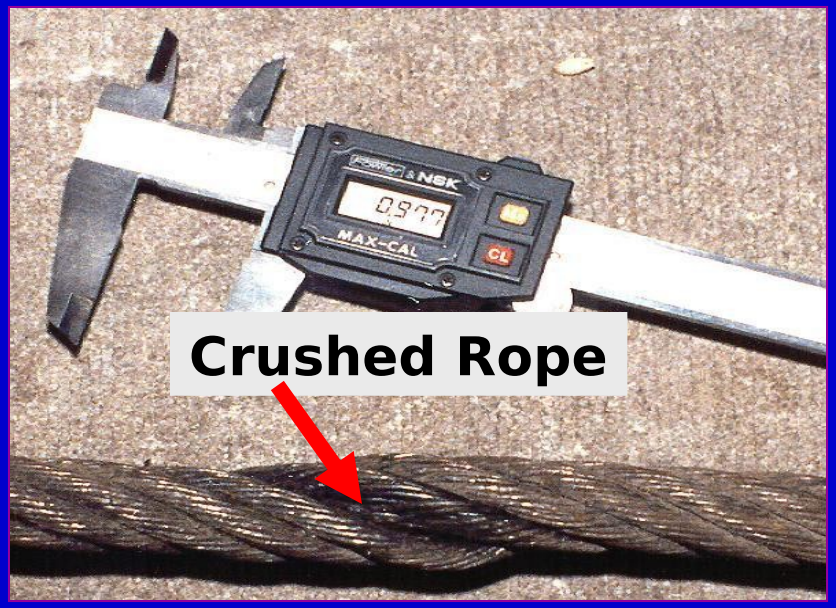
What to Inspect

- Correct air pressure and no leaks
- Tires properly inflated
- Clearance for tail swing
- Wire rope wear
- Physical damage to crane
- Loose or missing hardware, nuts, or bolts
- Fluid leaks

Remove From Service

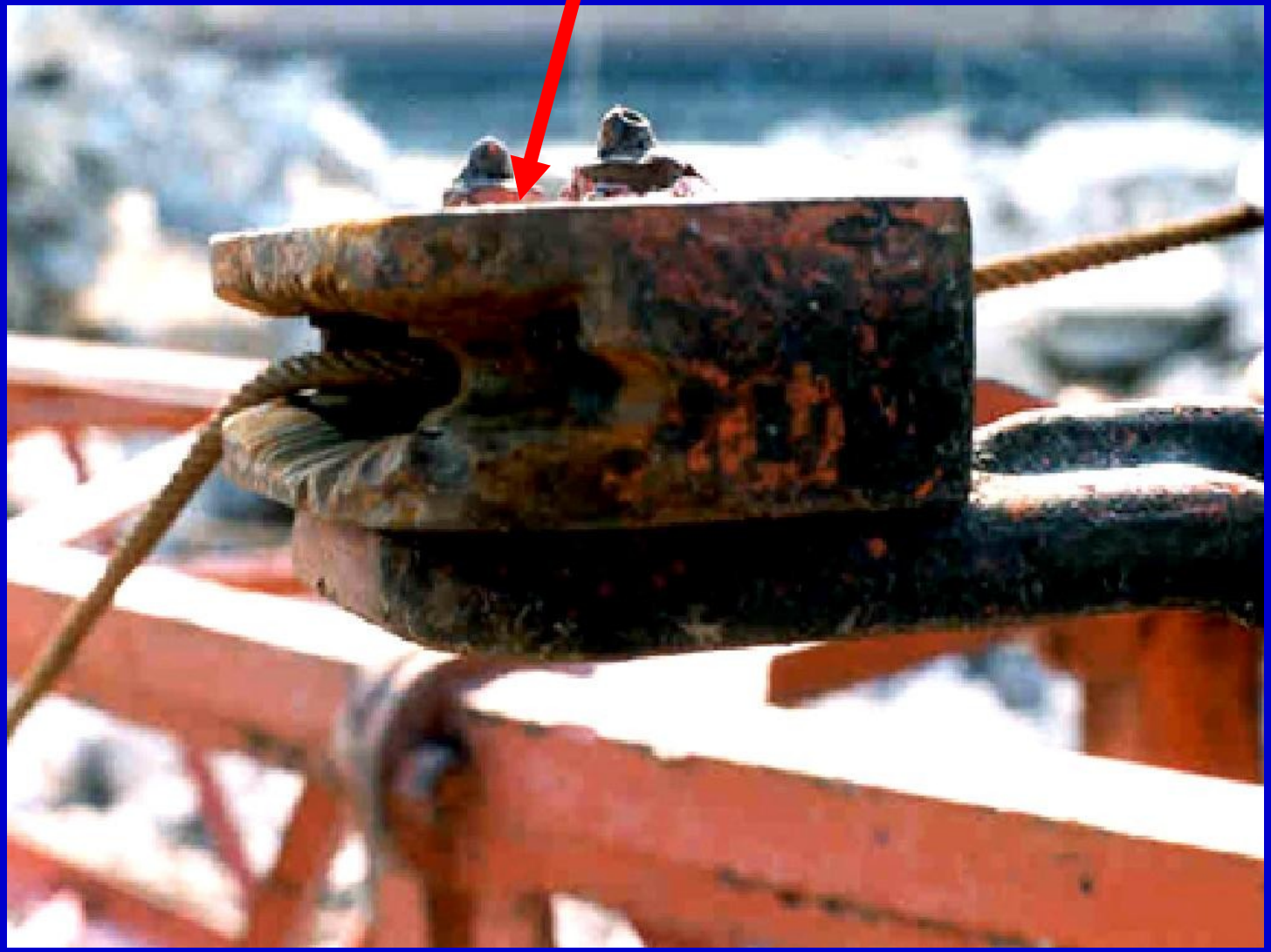
Immediately remove damaged or defective slings from service

Damaged wire rope



Damaged wire rope must be taken out of service

Worn Part



Tire Inspections

Conduct regular inspections of tires for excessive wear or damage

Training

- **Operators:**
  - **must qualify on specific crane type**
  - **Must include on-the-job training**
- **Supervisor / competent person**

Summary

- An unstable load, lack of communication, lack of training, and inadequate maintenance or inspection are major contributors to crane accidents.
- Operators or others working in the area can be victims to “struck by" and "caught in" injuries.
- Contact with power lines causes many accidents.
- A competent person must inspect a crane regularly to insure it is in proper order.
- Planning and training reduces accidents.